

Remarks

The Restriction Requirement

A restriction requirement was imposed between a Species A in which the first component is generic or a metal alloy and a Species B (claims 9 and 12) in which the first component is a polymeric material. This restriction requirement has been and is traversed.

In accordance with the rules of practice, applicants' attorney affirms the provisional election to initially prosecute claims 3-8, 10, and 11. However, it is requested that this restriction requirement be withdrawn for the following reasons.

Each of applicants' claims 3-12 recite a method of joining a first component to second, dissimilar, component. In accordance with the claimed methods, a self-piercing rivet with a head and hollow shank is driven through the first component and into the second component. At this stage of the claimed processes the rivet shank is embedded in the second component and the rivet head holds the first component in a mechanical attachment to the second component. Then, an electrical current is passed through the rivet and the second component to fuse material at the interface of the rivet and the second component. This provides a combination of a weld and mechanical attachment joining the first and second components. No claim recitation requires that electrical current pass through material of the first component or that the first component be electrically conductive. Insofar as the claimed methods are concerned, it makes no difference whether the first component is a metal alloy or a polymeric material. The practice of the claimed invention does not rely on a particular melting point or electrical conductivity of the first component. The claimed methods may be practiced in a like manner without reliance on specific properties of the first component and, thus, without regard to whether the first component is metallic or polymeric.

The Examiner refers to paragraph 0019 of the specification as requiring that the first component be exclusively metallic or polymeric. But paragraph 0019 permits the component to be a composite material, which doesn't exclude a mixture of metal and polymer. Paragraph 0006 also gives examples of many non-ferrous materials, including composites, which may be joined to a ferrous workpiece. And the illustrated practice of the invention throughout the specification reveals that the claimed methods do not require that the first component be only one of a metal or a polymer but not some combination of materials. The Examiner's restriction requirement is not

based on a necessary distinction as to the material of the first component in the practice of applicants' claimed invention.

The Claim Rejections

Claims 10 and 11 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. The Examiner is respectfully requested to reconsider this rejection.

The Examiner states that claim 10 fails to provide sufficient antecedent basis for the limitation "the sheet portion." in line 4. But the first line of claim 10 reads, "A method of joining a sheet portion of a non-ferrous component ..." (emphasis added). It is believed that this phrase provides a suitable antecedent basis for the phrase in line 4. It is urged that this rejection be withdrawn.

Claims 3-8 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Sunamoto et al.'498 in view of Mauer et al (newly cited) (2001/0027597). It is respectfully requested that this rejection be reconsidered and withdrawn for the reasons given below.

Claims 10 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al (2004/0197134, newly cited) in view of the Sunamoto et al patent and the Maurer et al published application. It is also respectfully requested that this rejection be reconsidered and withdrawn for the reasons given below.

The Claimed Methods

Claims 3 and 10 are the independent method claims remaining in this application. Limitations of these independent claims will be relied on in distinguishing the teachings of the references applied by the Examiner. The respective dependent claims, of course, provide additional patentable limitations.

The claims 3 and 10 methods require that dissimilar first and second components be placed together at a joining location. In claim 10, a sheet portion of a non-ferrous component is placed against a first surface of a ferrous tube. A self-piercing rivet, comprising a head and a

hollow cylindrical shank, is driven through the first component and into the second component to mechanically attach the first component to the underlying second component. After an initial mechanical attachment has been formed by piercing with the rivet, an electrical current is passed through the embedded rivet and the second component at the joining location for a period sufficient to weld at least the shank of the rivet to the second component. In claim 10, the current is passed from an electrode engaging the opposite surface of the ferrous tube. This current flows around the tube and into the embedded rivet.

Thus, the claimed methods comprise a mechanical piercing step with the hollow cylindrical shank portion of a rivet and then welding an interface of the embedded shank of the rivet with the pieced second component. An advantage of the claimed methods is that they do not rely on a specific material or melting point or electrical conductivity of the first component. The rivet simply has to be hard enough to penetrate through the first component into an electrically conductive second component. The claimed invention can be used to join an electrically non-conductive plastic part to a steel part or a ceramic part to a steel part or a non-conductive polymer composite to a steel part.

The References

The Sunamoto et al patent, U.S. 5,739,498 (hereafter Sunamoto for brevity) joins a first electroconductive plate member (e.g., an aluminum plate) to a second electroconductive plate member (e.g., a steel plate) using an electrical current and an “anchor peg.” The anchor peg is not a rivet with a hollow shank and the peg is not simply driven through the aluminum plate into the steel plate to form a mechanical attachment. Sunamoto applies a first electrical current to his anchor peg and the overlapping aluminum and steel plates. The electrical current passing from the peg into the electrically conductive aluminum plate promotes resistance heating to melt the underlying aluminum. The Sunamoto anchor peg simply melts its way through the aluminum plate until it contacts the underlying steel plate. Then, as illustrated in Sunamoto Figure 3, the electrical current is increased from a piercing current level to a welding current level and the peg is welded to the underlying steel plate.

Sunamoto relies on the electrical conductivity of his anchor peg and both of his overlapping plates to perform his joining process. He can only join electrically conductive workpieces because he relies on electrical resistance heating for the conduct of his joining

process. Sunamoto cannot join an electrically non-conductive plastic part to a steel part, or a ceramic part to a steel part, or a non-conductive polymer composite to a steel part. Sunamoto simply does not contemplate the use of a self-piercing rivet to mechanically and forcibly penetrate a first component, regardless of its electrical conductivity or melting point, and mechanically engage a second component to which it is then welded in a distinct joining step. There is nothing in the Sunamoto practice that requires (or even suggests) the use of a self-piercing rivet with a hollow cylindrical shank for joining dissimilar components.

Regardless of the absence of any Sunamoto teaching of the use of a hollow shank rivet, the Examiner looks to the Mauer et al Patent Application Publication U.S. 2001/0027597 (hereafter Mauer for brevity). Mauer uses a rivet, which may be a self-piercing rivet. Mauer discloses a complex system for joining workpieces by riveting. The workpieces may be of different sizes and require rivet of different lengths. But with all of the complexity of his disclosure, Mauer does not combine riveting with electrical resistance welding so as to join two components of dissimilar materials. Mauer does not make a welded joint.

There is no basis in either Sunamoto or Mauer for combining their different teachings of joining processes. There is no suggested need in the electrical resistance practices of Sunamoto for a self-piercing rivet. And there is no suggestion in the Mauer disclosure for an electrical resistance welding step. The Examiner's combination of these references is based only on a hindsight gleaned from applicants' claims. But hindsight is a wholly improper basis for combining references in rejecting applicants' claims 3-8. The rejection of claims 3-8 as unpatentable over the combination of Sunamoto and Mauer should be withdrawn.

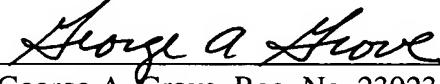
The rejection of claims 10 and 11 is based on the Wang et al published application (2004/0197134, hereafter Wang for brevity) in view of Sunamoto and Maurer. While Wang attaches a flange sheet to a tube surface by riveting or welding or adhesive bonding, the methods of claim 10 is not disclosed or suggested.

The Wang disclosure generally relates to forming tubular joints in constructing motor vehicle frames. Wang seeks to make use of hydroformed tube members in vehicle frames and provides flanges and protrusions that facilitate joint formation. But Wang gives no attention to the compositions of the tubes and there is no suggestion of the use of dissimilar materials in forming the frame or attachments to it. Wang is not requiring vehicle frame builders to join dissimilar materials. Certainly there is no suggestion in the Wang publication of resort to the

methods of claims 10 and 11. The combination of Wang with Sunamoto and Mauer does not teach or suggest the methods of claims 10 and 11 for the reasons given above. Sunamoto uses electrical resistance heating to melt a first material for penetration by his anchor peg, and then uses a higher level of resistance heating to weld the peg to a different and underlying material layer. Mauer uses self-penetrating rivets without any heating or welding. Sunamoto and Mauer simply disclose alternative and distinct joining methods as suggested by Wang. Sunamoto and Mauer contain no disclosures that suggest their combination in any way. And there is no combination of Wang, Sunamoto, and Mauer that teaches or suggests the invention recited in applicants' claims 10 and 11.

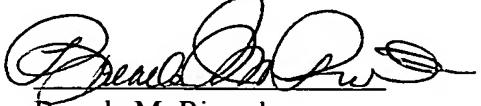
The rejections of claims 3-11 are groundless and should be withdrawn. Claims 9 and 12 should be considered in this prosecution and are allowable over the prior art. Accordingly it is respectfully requested that each of claims 3-12 be allowed in this case and the case passed to issue.

Respectfully Submitted,


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